Important infectious diseases at Biharamulo Designated District Hospital in rural Tanzania

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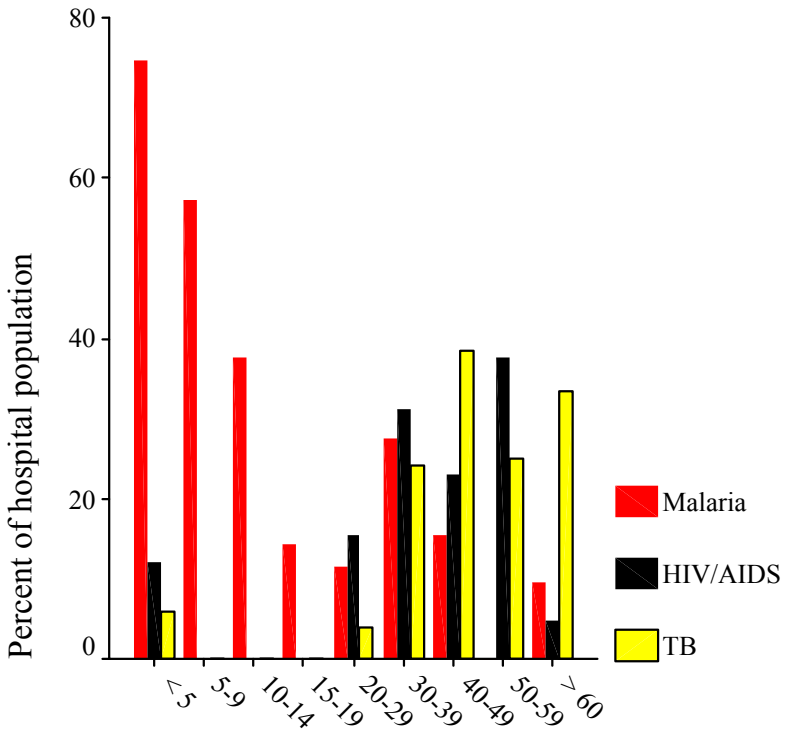
Student Thesis

University of Oslo



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Abstract

Objective: The study aimed at assessing the prevalence and management of infectious diseases, with main focus on malaria, HIV and TB, in a rural hospital in Western Tanzania.

Design: Spot prevalence study.

Methods: Information gathered from staff and patient notes on ward rounds and subsequent interviews of patients.

Results: Of the 102 hospitalised patients included in the study 37/102 (36%) were diagnosed malaria, 15/102 (15%) with HIV/AIDS and 14/102 (14%) had TB. Out of the TB positive individuals, 50% had a coexisting HIV infection. HIV was more frequent among the female patients (16%) than the male patients (13%) and the peak age group for HIV-infection was 50-59 years old. Malaria was most frequent among children aged 0-5 years. 52% of hospitalised patients were treated for malaria without having the diagnosis verified by blood smear. The National first line antimalarial treatment was not used. 94% of hospitalised patients received medication. 60% of the patients were prescribed antibiotics, 35% received antimalarial medication, 8% followed the national guidelines for TB-treatment with Direct observational treatment (DOT).

Conclusion: The most frequent diagnoses of this hospital, malaria, HIV and TB must represent a considerable burden. The difficulties in managing these infections at a hospital with limited access to modern laboratory equipment and well-trained staff are revealed in this study. More resources are needed to ensure implementation of National Guidelines and to optimise the health provision at BDDH.

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Introduction

The United Republic of Tanzania (Tanzania) and the region of Kagera where this study was conducted are facing major health-challenges, first and foremost associated with infectious diseases, such as malaria, human immune deficiency virus infection (HIV-infection) and tuberculosis (TB). A report from Kagera has shown that less than 5% of the population live under appropriate sanitation conditions, and only 10% have access to safe water (1). These and other socio-economic aspects may be associated with the vulnerability to infectious diseases and difficulties in managing them.

The HIV epidemic is one of the major challenges for the Tanzanian health-service, even though the 9% prevalence of HIV in Tanzania is among the lowest rates in Eastern Africa. The first case of HIV in Tanzania was reported in 1983 and was discovered in Kagera, where neighbouring conflict areas and immigrants have since aggravated the burden of HIV-infection (1). Also loss of staff from HIV has increased the burden of HIV. The lack of well-trained health-care workers in general may make it hard to manage infectious epidemics, in total there are only 49 doctors in the region of Kagera, with a population of 1 783 600 (population pr doctor: 36 400) (2).

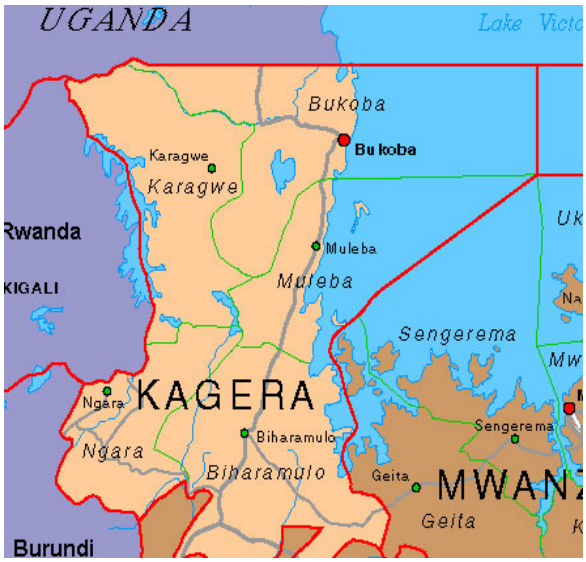

Figure 1 and 2: *Biharamulo where the study was conducted is a town in the region of Kagera, Northwest in Tanzania, East Africa (3).*

The life expectancy in Tanzania rose from the 1950ies up until the end of the 1980ies, when the emerging HIV-epidemic led to a decrease in the mean life-span (4). Life expectancy at birth in Tanzania in the period 2000-2005 was 46 years for male and female. Infant and child mortality rate has also risen during the 1990's. In 2004 the under five mortality rate was 165 per 1000 live births (5).

At the onset of the HIV epidemic there was a simultaneous increase of TB infection. The notification rate of TB in Tanzania has increased threefold from the 1980ies (6) and in 2002 the TB prevalence was estimated to be 472/100 000. Although some increases may be due to staff compliance the association between HIV and TB has long since been established, and out of the TB infected individuals in Africa, 40% have been found to be HIV positive (6).

All of the 35 million citizens in Tanzania live at risk of malaria, at least for parts of the year (7). The Tanzanians constitute the third largest population at risk of malaria on earth. At least 26% of the country is prone to malaria (7). It has been estimated that one Tanzanian, nearly always a child, dies of malaria every five minutes (8). The number of malaria cases in Tanzania is 14 to 19 million per year and the estimated number of deaths is 100 000 to 125 000, of which 80 000 are children under 5 years of age (7). In 2003 there were 10 712 526 reported cases of Malaria in Tanzania (9).

National guidelines on malaria, HIV and TB exist, and are in various degrees implemented in the district hospitals. There are, however, still major problems with antiretroviral therapy (ART) provision, among other reasons due to economical and logistic problems (10).

This spot prevalence study aimed at assessing the frequency and management of infectious diseases, with the main focus on malaria, HIV and TB, at a rural hospital in Western Tanzania in the dry season:

1. To find the prevalence of the different diagnoses of all admitted patients
2. To evaluate management of malaria, HIV and TB with regard to the National guidelines
3. To assess the diagnostic procedures and possibilities
4. Compare local data with existing knowledge in the field

Material and Methods

STUDY HOSPITAL AND ENCATCHMENT AREA

The North-western highlands of Tanzania where Biharamulo is located, has two rainy seasons from November to December and February to May (11). Temperature, humidity and rain are factors that will determine the Anopheles mosquito's chance to survive and make the malaria transmission possible (8).

The study was conducted in June-July 2005 at Biharamulo Designated District Hospital (BDDH), one of four district hospitals in the region of Kagera in North-Western Tanzania. The population of Kagera is about 1.8 million and covers an area of 40 838km^2
The district of Biharamulo holds a population of 472 269 people (12).

The hospital was founded in 1969 by a Dutch nun of the Roman Catholic Church. The Diocese of the district, the Rulenge Catholic Diocese still owns the hospital buildings and organizes the staff and hospital management. The hospital is now government funded and the government is also meant to supply the hospital with essential HIV-medication.

BDDH had four wards comprising a maternity ward, a children's ward, a male ward and a female ward. Surgical patients were mixed with medical patients. In addition, approximately 100 patients were seen a day by Clinical Officers or Doctors at the Out Patient Department (OPD).

Within the region of Biharamulo, there were four levels of health-care. The first level included "Village health posts" and the second level comprised "Dispensaries". From level three, the "Health Centres", patients could be referred to the district hospital. However, most patients were admitted from the OPD at the hospital, where the patients lined up early in the morning.

Figure 3: *Clinical work at a village health point*

If strictly required, patients in need of further investigation, such as Computer Tomography or certain treatment, e.g. chemotherapy, were referred to a tertiary institution, Bugando hospital in Mwanza, which is one of the four major consultant hospitals in Tanzania. Each month approximately three patients were referred to Mwanza. The transport capacity was limited, with only one local vehicle for patient transport available, and patients were often too weak to travel the 7-8 hours journey by car. Approximately only once a month samples for CD-4 testing were sent from the hospital, unless the patients themselves were able to pay the expenses. Laboratory results (e.g. surgical biopsies, CD 4 counts) were reported back to the hospital via email or fax, approximately a week later.

The choice of investigation and treatment were often dependent on the patient's economy. The price of a standard blood smear at BDDH was 300 TZS (0.24 USD) (appendix 5). However, blood-smears were performed regardless economical concerns, if considered strictly necessary. There was a "poor people's fund" at the hospital, to cover expenses associated with emergencies and unforeseen events.

STUDY POPULATION

The selection of patients and timing of the study conduction were done along with the Medical Doctors (MDs) during ward rounds. These took place Mondays, Wednesdays and Fridays. Study observations and notes were made throughout the ward rounds. The two doctors in charge of the ward rounds clarified information. Some information was gathered immediately after the ward rounds. Each ward was visited once weekly. Unless unforeseen events appeared, the ward rounds occurred at an established day and time. Whether the patients were informed about the timing of the ward rounds is unknown. Data were collected over a period of three weeks July 2005. The maternity-, male- and female wards were visited twice and the children's ward was visited once. In order to calculate the average prevalence, the number of registered patients in the adult wards for 2 days was divided by 2.

As shown in table 1, the number of beds in the children's ward was 44. However, up to three children shared a bed, and the number of children hospitalised at the time of study conduction was 50. Children above the age of five years, were generally placed in the male or female wards, however, children up to eleven years were often seen in the children's ward due to shortage of beds.

The maternity ward comprised women who choose to deliver at hospital, women with complicated pregnancies, and babies up to the age of one month. Surgical, medical or psychiatric cases were mixed in the female and male wards.

Hospitalised patients seen at the major ward rounds were invited into the study. Patients were included during the major ward rounds. The children below the age of one month at the maternity ward were excluded from the study. Patients reluctant to participate, patients who had left the room and patients who were too weak to answer were excluded from being questioned. However basic information (duration of stay, diagnosis and treatment) was gathered from the patient notes when possible.

CLINICAL INFORMATION

Patient notes were used as the most important source of information. The registered symptoms were present at the time of the study, with main focus on common symptoms associated with infectious diseases (appendix 4). Growth charts could not be observed at the

children's ward, due to unavailability at the hospital. The data collected at the maternity ward focused on urinary symptoms and recorded notes.

A pilot was conducted to test the questionnaire on a limited number of patients under supervision from local doctors and nurses, in order to see whether a translator was required, and to improve it. Together with the staff at BDDH, we concluded that the study could be conducted without a permanent translator, despite some language problems.

Some patients classified into several diagnostic groups. These individuals were classified with the diagnosis for which they were treated as their primary diagnosis. The HIV group comprised the patients with HIV as the primary or secondary diagnosis. The AIDS diagnosis (Acquired Immune Deficiency Disease) was determined by using World Health Organisation's (WHO) criteria (13). In the data collection form some terms were used that needed a more accurate definition. Vomiting and diarrhoea per 24 hours were the number of episodes with vomit and diarrhoea today and yesterday.
Problems with eating and sucking in case of breastfeeding (anorexia) were registered as feeding problems in children. The prostration of children was registered, meaning the child's inability to sit upright in a child normally able to do so, or to drink in the case of children too young to sit.

LABORATORY ANALYSIS

The information on laboratory- and radiological investigations and current medication were retrieved from information in the patient's notes. The available laboratory equipment has been listed in appendix 3.

The hospital had one laboratory with 9 employees. The head of the laboratory, Mr.Tibaijuka Witness was interviewed, and some of the procedures were demonstrated. The diagnosis of malaria was routinely done by microscopy of a single thick blood smear collected by a finger-prick. Fieldastain (A+B), an affordable substitution for Giemsa, was the dye used for the blood-smear preparation. The smears were dried in the window and subsequently investigated under the x100 lens of the light-microscope. For diagnosis of malaria, at least 50 fields were inspected, and the number of parasites was counted in proportion to 200 WBC. Three available light microscopes were also used for urinary analysis and faeces tests.

Sputum-smears coloured by Ziel-Nielsen dye were performed. Equipment for examination of lumbar puncture specimen fluid was also available however the procedure was not performed during the study-period. HIV antibody-tests were performed routinely at the hospital. Specimens for CD-4 counts were sent to Mwanza. For haemoglobin-investigation the laboratory routinely used *Corning colorimeter*. Other haematological investigations such as full blood count (FBC), mean cell volume (MCV), mean cell haemoglobin (MCH) and cell morphology, could only be performed by microscopy. For biochemical-tests, the *Biosystem Bts-305 Photometer* was used. This tool could potentially be used for a vide variety of tests, including Polymerase Chain Reaction (PCR). However, the whole machine was currently not in use, due to lack of expensive reagents.

Equipment for analysis of bacteriological cultures and electrolytes were not available at the hospital. If strictly required, electrolyte analyzes could be ordered from Bugando hospital in Mwanza, where a flame photometer was available

ETHICAL CONSIDERATIONS

All work was conducted under the supervision of local Doctors. Permission to conduct the study was obtained from the hospital-administration and the MD in charge. Patients who had left the room at the time of questioning or patients who were reluctant or too weak to answer questions were excluded from being questioned.

In order to ensure patient confidentiality, the data shuts were anonymous. The names, fathers' names and addresses of the patients were registered in a Master register only linked to the patient through the bed-number. The word "serology" was used in the questionnaire as a code for the observation of performed HIV-testing.

STATISTICS

Chi-square and Fisher's exact tests (for numbers < 5) and odds ratios (ORs) with 95% confidence intervals (CIs) were used when studying the association between two categorical phenomena. To study simultaneously the impact of several variables, logistic regression analysis was applied on those variables where Spearman Rank coefficient was less than 0.7 and where $p<0.2$ in bivariate analysis. Statistical analysis was done using the Statistical Package for the Social Sciences version 14 (SPSS, Chicago, IL).

Due to missing or illegible information from the patients' notes, there are missing values on some variables. Therefore the figures do not always sum up to the number of registered patients.

Results

In the adult wards, it was manageable to include all patients seen during the major ward rounds. 166 patients were registered during the attended ward rounds. 50 of the patients were registered in the male ward, 53 were in the female ward, 37 in the children's ward and 26 in the maternity ward. Due to missing values of certain variables, not all of the analyses are based on the same number of investigated patients.

Table 1 shows that children comprised 37/102 (36%) of the registered patients. The spot-prevalence of patients in the male ward was 25/102 (25%), 27/102 (26%) were in the female ward and 13/102 (13%) were in the maternity ward. 83/102 (82%) of the patients had a medical diagnosis, while 25/102 (25%) were registered as surgical patients. Seven out of 102 patients presented with both surgical and medical diagnoses (7%).

Patients had been hospitalised a mean of 7.2 days (range 1 - 37 days). The study showed that the percentage of days the patients had been hospitalised varied between the wards. 26/35 (74%) of the children had been hospitalised ≤6 days. In the male ward 13/25 (52%), female ward 15/25 (60%) and in the maternity ward 8/12 (67%) had stayed ≤6 in the hospital.

DIAGNOSIS

As shown in table 2, malaria is by far the most frequent diagnosis in this study, followed by TB, HIV and a range of surgical diagnosis. 14/102 (14%) of the patients presented with TB. 7 of the TB positive individuals (50%) had a coexisting HIV infection. In the children's ward and also in the female ward we found malaria to be the most common diagnosis, whilst TB was most commonly found at the male ward (table 3).

Other frequent diagnoses were other infections such as pneumonia and diarrhoea (appendix 1 and 2). No lumbar punctures were conducted during the time of study despite a number of suspected cases of meningitis (appendix 1 and 2).

HIV

Fifteen out of the 102 surveyed patients (15%) had HIV. Among the female patients, 9/58 (16%) presented with HIV, compared to 5/40 (13%) of the male patients, in total, 55% of the HIV positive patients surveyed were female and 45% were male patients. As shown in figure 5, HIV is most prevalent in the age group of 50-59, and there is also a high prevalence among young adults and the under five's.

Five of 97 (5%) of the patients surveyed were tested for HIV-antibodies during the hospitalisation for the period of study conduction. Four-in-five of the HIV tested patients were found to be HIV positive. One of 14 (7%) of the registered HIV-patients were infected with hookworm, in contrast to 1/82 (1%) of the HIV-negative patients. Schistosomiasis was not found in any of the groups.

HIV was significantly associated with TB, 7 out of the 15 HIV positive patients had a coexisting TB (47%) as opposed to "only" a 9% (8/87) prevalence of TB in the HIV negative group. The finding remained significantly associated after entry of sex and age in the multivariate analysis (OR 9.8, 95% CI 3.4-28.1, p=0.001).

We also found a significant association between HIV and cough, also after controlling for age and sex in the multivariate analysis. Ten out of 12 of the HIV patients had cough as a symptom (83%) as opposed to 29/57 (51%) of the HIV negative patients.

TUBERCULOSIS

The peak age groups for TB in this study were 40-49 and the age group above 60 (figure 5). Six out of 14 patients with TB (43%) had an x-ray finding suggesting TB. All the 13 TB patients in the spot-prevalence study had an existing cough during the study (100%). In contrast, 27 out of the 56 non-TB patients registered (48%) presented with a cough. Eight of 14 (57%) of the TB patients were registered as recipients of tuberculostatics and Direct observational treatment (DOT).

MALARIA

Thirty-seven of 102 (36%) of the hospitalised patients were diagnosed with malaria. Out of the registered malaria patients 52% got the diagnoses without a confirmed finding of parasites in the blood smear. 13/ 25 (52%) were treated (for malaria) without having the diagnosis

verified by blood smear. The denominator varies due to missing values with regard to treatment. No patient received the National Guideline first line antimalarial treatment (Appendix 4).

Most malaria cases, 25/37 (67%), were children between 0-5 years. Out of a total of 12 patients with more than 200 parasites per 200 WBC, 10 (83%) were children between 0-5 years.

MANAGEMENT

We registered management in 95 cases and 90/95 (94%) of the patients received medication. 57/95 (60%) of the patients were prescribed antibiotics, 33/95 (35%) received antimalarial medication. As shown in table 4, almost half of the patients with Malaria received antibiotics, most of them in addition to antimalarial treatment. Among the TB-group 68% received antibiotics in addition to tuberculostatics.

At BDDH more than 50% of the patients who received antimalarial drugs received quinine. The second most frequent antimalarial drug in use was sulfadoxine/pyrimethamine (SP) tablets, either prescribed separately or in combination with quinine. The most frequently used antibiotics at BDDH were cloxacillin, chlorampenichol, metronidazole, gentamycine, co-trimoxazole and phenoxymethyl penicillin.

When we look at the prescribing of medication according to age, we find the peak in the group < 5 years. Out of the 82 patients registered for treatment, 31/82 (38%) occurred in the group under five years. Out of the patients receiving antimalarial drug, 23/33 (70%) were under the age of 5 years. The peak age group for taking antibiotics were the children under five years of age. 16/52 (31%) were in this group.

In total 20/93 (22%) of the patients received blood-transfusion during their hospitalisation. 53/102 (52%) of the hospitalised patients had their Hgb (haemoglobin) measured. Out of these 53 individuals, 5 patients (9%) had Hgb values below 4 g/dl, the hospital cut off for recommending blood transfusion. 3/5 of the patients in this highly anaemic group were diagnosed with Malaria.

Blood-transfusion was given to 33% of the patients diagnosed with malaria, compared to 15% of the patients registered with other diagnosis. This significant association between blood-transfusion and malaria remained after entry of sex and age in the multivariate analysis (OR 4.1, 95% CI 1.6-10.5, p=0.003).

Figure 4: *Marianne Solberg is investigating a child suffering severe malaria.*

Discussion

Infectious diseases accounted for the highest burden of diagnosis at BDDH. Almost 40% of all admitted patients in the hospital had malaria. Our data indicate that children below the age of five were vulnerable to develop malaria. These numbers are supported by the literature (5). In malaria-endemic countries in Africa such as Tanzania, between 20% and 50% of all hospital admissions are associated with malaria. The results from this study may be seen as typical for a rural Tanzanian hospital. The age distribution of malaria cases found in our study has also been reported previously (14).

There are clear limitations in our choice of a spot prevalence study design and our small number of investigated patients also makes it difficult to compare our figures to existing literature. In most developing countries it may also be difficult to extract a full picture for exact health statistics in the literature (15).

In the questionnaire, certain medical terms, such as dyspnoea could not easily be translated directly to Swahili, and were therefore translated to “kifoua kina bana” meaning discomfort at breathing/chest tightness. Particular symptoms, for instance “significant weight loss during the last three months”, were excluded from the data entry, first and foremost because a limited number of patients had access to scales.

All patients were normally seen during the ward round, and in order to find the most reliable spot prevalences, also the unavailable patients were included in the study with information from their notes only. The patients excluded from the symptoms’ questionnaire due to unavailability may have represented a bias. We assume that a larger proportion of the healthiest patients would tend to leave their bed compared to the more severely ill patients. However, also the patients with decreased consciousness, who were too weak to answer, were excluded from the symptoms’ questionnaire. This means that the patients questioned were most likely around the mid point of a scale from mild to severe illness. Due to both overload of children in a chaotic environment and problems tracing the patient notes after the ward round, it was impossible to include all individuals in the children’s ward. This selection may have represented a bias in the study. However, the exclusion of patients from the children’s

ward was merely based on availability of notes. Most likely the problems with tracing patients' notes were not associated with the condition of the patients and the children included in the study may well be representative for the hospitalised children. However this is not known.

HIV

Fifteen percent of the hospital population was HIV positive and had an HIV-related disease. This patient group must represent a considerable burden for the hospital. Women were over-represented among HIV infected individuals, constituting a fraction of 55% of the HIV positive in-patients. This higher prevalence among women is consistent with existing data (15). World-wide, the literature points out a higher HIV prevalence among men than women. In sub-Saharan Africa however, more than 55% of the HIV infected individuals are women, compared to approximately 48% worldwide (15;16). On average, in sub-Saharan Africa there are approximately 13 women living with HIV for every 10 infected men (16). Figures from Tanzania have shown that 7.7% of the women and 6.3% of the men were HIV positive in 2003-04 (17). In total, 7 % of Tanzanian adults were HIV positive in 2003-2004. Our figures are however low and results must be interpreted with caution.

The age distribution of HIV patients (figure 5) is comparable to the figures found in the 2003-04 Tanzania HIV/AIDS indicator Survey (THIS) (18) Our finding of a HIV-infection peak in the age-group of 50-59 is however not typical. The THIS found that prevalence for both women and men increase with age from the age of 15, until they reach a peak. For women the peak age is found to be 30-34 (13%) and for men 40-44 years old (12%) (19). In sub-Saharan Africa however, HIV peaks at a younger age, 25-29 is typical of many studies.

Our diagnostic data will certainly not be representative of rural Tanzania, mostly because of the choice of a hospital population such as inclusion criteria, and because of the small number included in the study. The choice of a study design without a follow-up also makes it impossible to look at developing trends and changes in incidence and prevalence. Our study did neither distinguish between the two main types of the HIV virus and therefore the figures are not directly comparable to studies where HIV-1 is studied separately. However, HIV-1 is the dominant serotype in East Africa and can therefore be used as a practically accurate estimate for total HIV-prevalence in the region.

Published papers show a higher HIV prevalence in urban areas compared to rural areas (12;20). The THIS (21), found a prevalence in urban areas of 9.6% compared to figures in rural areas, with a prevalence of 4.8%. Also Kwesigabo et al. (12) found a profound difference between rural and urban areas in their study conducted in our Kagera Region. Within the urban districts of Kagera (Bukoba, map figure 2) the prevalence of HIV-1 was 13.3% in 1996, having declined from 24.2% in 1987. In contrast, the age-adjusted prevalence in the most rural area studied (Karagwe, map figure 2) was "only" 2.6% in 1999.

Biharamulo is a rural area, where a lower HIV rate must be anticipated. On the other hand, a higher prevalence is expected in a hospital population. According to the local Doctors, the hospital policy stated that it was mandatory for in-patients with a TB infection to do an HIV antibody test and thereby also to go through counselling. Also, after a staff prick-injury HIV tests could be demanded off patients. Pregnant women were advised but not obliged to undergo an HIV test. Also for diagnostic purposes HIV testing is recommended, however not mandatory. During the time of study, it was debated at the hospital whether HIV testing should be mandatory for pregnant women with suspected HIV. Only a limited number of HIV patients were tested for CD-4 counts in Mwanza, even though CD-4 counts according to local doctors were needed in the region.

Since the first HIV case in 1983, figures have shown a stable prevalence or a prevalence on slow increase in Tanzania (15;22). According to the 2004 Joint United Nations Programme on HIV/ AIDS (16), there is no sign yet of an overall, national decline of HIV in any southern African country, except in Uganda and Zimbabwe (23). In addition, the follow-up study of Kwesigabo et al. (12) conducted in three districts in Kagera in the period between 1987 and 2000 found a decline in the HIV-1 prevalence and incidence in all three districts. In the medium-prevalence area (Bukoba rural and Muleba districts, figure 1) the age-adjusted prevalence declined from 10.0% in 1987 to 4.3% in 1999. National figures from 2003 shows a HIV-prevalence of 8.8% in the age group 15-49 (24), as opposed to the 7 % HIV-prevalence among Tanzanian adults found in the THIS conducted in 2003-2004 (25).

To our knowledge there are no papers on the current capacity of the Tanzanian health care to deliver ART (10). National guidelines on HIV-treatment in Tanzania exist, but were not widely implemented. At BDDH efforts are currently made to gradually introduce the ART supplied by the Government.

TUBERCULOSIS

There was a clear association between HIV and TB. This significant association is probably the main explanation for the strong association between cough and HIV found in this study. The diagnostic tools used for confirmation of clinical TB vary and may influence the statistics. In BDDH, where culture-equipment was not available, the clinical diagnosis is confirmed by microscopy of sputum-smears. Thereby, it is difficult to differentiate between *Mycobacterium Tuberculosis* and other species of the *Mycobacterium* family. However, in a hospital population, a higher coexistence is not surprising and may well be representative for other hospital populations, given that in-patients most likely have more advanced stages of diseases compared to ambulant patients.

TB is the leading cause of death among people with HIV/AIDS and the TB infection should be seen in association with the HIV-epidemic (26). Since the 1980s, the rate of sputum-smear positive TB has risen two-fold (6). Most of this increase has been explained by the coexisting HIV epidemic. HIV infected patient is 500-800 times more likely to develop primary TB infection than other individuals, and the risk of transformation of TB from a latent state to a clinical state increases 30 times with coexisting HIV (26). Worldwide, statistics have shown that approximately 30% of the occurring TB coexists with HIV-infection (27).

At BDDH at the time of the study national guidelines on management of TB were implemented, in contrast to HIV-guidelines, which were not yet implemented. Not all the patients with the TB diagnosis had records indicating reception tuberculostatics. Among the other TB individuals it is assumed that some received tuberculostatics even though it wasn't registered in the notes while others were newly diagnosed with TB and the treatment was not yet commenced. A large proportion of these patients were treated with antibiotics, either in addition to, or without tuberculostatics. The uncertainty regarding the verification of the TB-diagnosis and possibility of differential diagnosis such as respiratory infections may explain this choice of treatment. Also it must be stressed that not all the patients' notes were properly documented and not all medication intended to be commenced by the doctors at the ward rounds was administered by the limited number of staff available. Despite the obvious association between HIV and TB, it is suggested that in presence of strong TB management programs, the impact of the HIV epidemic on TB transmission could become limited (6;6).

MALARIA

Our study was conducted after the spring rainy-season. Nevertheless, malaria was by far the most frequent occurring diagnosis registered at BDDH. As mentioned earlier the children at the hospital carried the highest burden of the disease. The study has also shown that a relatively large number of malaria patients got the diagnosis without verification by blood-smear.

BDDH gives a good picture of a hospital in a malaria-endemic country in Africa. To give a better image of the malaria burden in Biharamulo it would also have been interesting to do a spot prevalence study in the rainy-season. According to local doctors tents were placed in the hospital area to be able to cope with the numerous patients with malaria in the rainy-seasons from November to December and February to May.

In many malaria-endemic areas, there is a lack of resources and trained health personnel so that clinical diagnosis is the only realistic option (9). At BDDH we experienced that limited availability of diagnostic confirmation occurred because of lack of ability to pay for laboratory consumables needed for diagnostics. However, "the poor-people's fund" at BDDH should cover expenses for patients not able to afford a blood-smear. One explanation for not taking blood-smears could be that the allowance had run out. Another explanation could be that the clinicians found their clinical diagnosis reliable and therefore did not find the procedure strictly necessary.

At BDDH more than half of the patients' prescribed antimalarial drugs received chloroquine and near ten patients received SP tablets. None of the malaria patients where registered with Artesunate, the first line treatment according to National Guidelines. The difference in price is obvious (28), and this could be the explanation why the staff at BDDH favoured prescribing the cheaper alternatives to Artesunate.

In areas where malaria is highly-prevalent, clinical diagnoses may entail that all patients with fever – and no obvious other cause – will be treated for malaria. Attempts to improve the specificity of the syndromatic approach for malaria have been made. The Integrated Management of Childhood Illnesses (IMCI) programme have defined an algorithm in order to ease the problems of making the right diagnosis in rural areas such as Biharamulo with limited access to laboratories and special equipment . WHO suggests, with this algorithm, that

every febrile child living in high-risk areas for malaria should be considered to have, and be treated for, malaria (29). High risk areas have been defined as areas where more than 5% of febrile children between the ages of 2 and 59 months are parasitemic (29).

The treatment policy of febrile children without a confirmatory blood-smear could lead to over-diagnosis and misuse of antimalarial drugs. On the other hand, prompt and effective treatment of malaria within 24 hours after onset of symptoms is important to prevent progression to severe disease and death. Babies up to two months of age are partly protected by maternal antibodies (30;31). As these antibodies decrease with time, they will be more vulnerable to severe malaria. A small child has not been subject to repeated attacks of malaria and has not developed a partial protective immunity (8). At BDDH we found a significant association between malaria and fever, a finding that supports the clinical approach performed by the clinicians. To evaluate the algorithms used in malaria detection, a study was done in Tanzania. The study showed that IMCI-trained health workers gave more correct antibiotics and antimalarials than colleagues who did not follow the IMCI- program, and prescribed less antibiotics to children not needing them (29).

At BDDH almost 50% of the patients with malaria received antibiotics in addition to antimalarial drugs. Most frequent was the combination of chloroquine and Phenoxymethyl penicillin. Whether this was due to diagnostic uncertainty or the presence of a co-infection is unknown. In cases with severely sick children, it may be hard to distinguish the symptoms and different diseases. Shock-symptoms like cold, clammy skin and low blood pressure may be caused by many diseases. Health workers should therefore also suspect bacteraemia and consequently give both an antimalarial and antibiotic treatment (32). This policy and the knowledge of how fast bacterial disease may develop into a severe condition could explain the frequent use of antibiotics such as Cloxacillin and Chloramphenicol in addition to antimalarials (table 4).

Antimalarial drug resistance has become one of the greatest challenges in malaria treatment. Chloroquine (CQ)-resistant *Placmodium falciparum* (*P.falciparum*) malaria has been reported where *P.falciparum* is transmitted. Chloroquine being the cheapest and by far the most widely available antimalarial drug, has become a large problem. A study done on Tanzanian-mainland from 1997-2001 concluded with a clinical-failure (median) percentage at 43% for CQ in treating uncomplicated *P.falciparum* (29).

SP-resistance is now becoming more frequent in Africa as this drug is increasingly relied upon as a substitute for chloroquine (29). In addition, several newly developed drugs replace those that are no longer effective. In particular, the combination therapies with Artemether-lumefantrine (ATM-LUM) have enormous potential in malaria therapy. The combination of multiple drugs makes the clinical efficacy more likely and may delay the development of resistance. Figures have shown a clinical failure percentage of 10.2% for SP and 3.4% for Amodiaquine (AQ) +SP) in treating uncomplicated malaria. These drugs are however not widely available and not always affordable (29).

More than 30% of patients with malaria received blood transfusion during hospitalisation and more than half of the patients with Hgb-measurements < 4g/dl were diagnosed with malaria. As mentioned earlier Hgb< 4g/dl was the hospital cut-off for blood-transfusion. Malaria is one of the factors causing anaemia among children (33) and makes the burden of the disease harder to bear. We were told by local clinicians that recruiting blood donors was difficult. The hospital dealt with this problem, by making the patients who had received blood to give back to the hospital the same amount of blood as he/she had received. This was to be done before discharge. Together with availability the hospital had problems with storage of blood.
On the other hand, blood-transfusion is not always the best solution in sub-Saharan Africa. The blood could be infected with HIV, even though it is tested for HIV-antibodies. The prevalence of contaminated blood varies: 0.5-20% of transfused blood in sub-Saharan Africa (34). The possibility of acquiring HIV-1 through blood transfusion must therefore be weighed against the risk of anaemia (34).

Conclusion

This small study in a rural Tanzanian hospital illustrates the burden of infectious diseases such as malaria, HIV and TB, and the considerable challenge in managing these epidemics. The syndromatic approach to treatment and diagnosis may be easier, faster, and hence cheaper. However, the diagnostic limitations due to lack of resources may impede quality of the provided health care. For instance at BDDH, lumbar punctures were not conducted during the study period and bacterial cultures were not available.

Malaria was by far the most frequent diagnosis at the hospital, especially among the children. The difficulties in confirming malaria have been illustrated in this study. Anti-malarial treatment is widely in use also in-patients without confirmed parasites, and anti-malarial treatment is often used in combination with antibiotics to cover for the differential diagnosis. Where laboratory investigations are unavailable, WHO and the National Guidelines endorse the use of clinical diagnosis based on algorithms. However, the National Guidelines for treatment of malaria were not always followed, among other reasons because the first line treatment was more expensive.

The burdens of HIV and TB have risen simultaneously in Tanzania (6), and almost half of the HIV patients surveyed in this study had a coexisting clinical TB infection. This strong association stresses the need for coping with the two epidemics in correlation. Mandatory HIV testing of TB individuals in accordance with the WHO guidelines are performed (35) at BDDH and National Guidelines on TB treatment are implemented. However TB and HIV patients were mixed in the hospital wards and the risk of transmission was imminent. Moreover, not all TB patients received anti-tuberculostatics. Furthermore, ART was still not administered in spite of existing national guidelines on HIV and ART. The recent plans for commencement of ART and the ongoing supply of drugs from the Government do however provide a glimmer for optimism. Nevertheless, more resources in terms of trained staff and laboratory equipment are essential to ensure implementation of both TB and HIV-guidelines and to optimise the management of malaria (29).

Analyses - tables

Ward	No of patients investigated	No of beds in the ward	Age group	Prevalence
Women	53	41	>5	27
Maternity	26	32	Mothers/children <1 month	13
Children	37	44	≥1mnth≤5	37
Male	50	48	>5	25
Average no of admitted patients (spot prevalence)				102

Table 1. *Overview of the wards and respective number of patients and beds*.

Footnote: Due to chaotic conditions only 37 of the patients in the children's ward were registered. With up to three children in each bed the total number of children was more than 44, and the confusion with mixing of notes and patients made it impossible to register all children.

Main diagnosis[a]	n (%)
Malaria	37 (36)
Surgical diagnosis	20 (19)
TB	14 (14)
Reproductive health conditions	12 (12)
HIV/AIDS[b]	7 (7)
Pneumonia	3 (2)
Diarrhoea	2 (1)
Cardiovascular	2 (2)
Other infections	4 (3)
Other diagnosis	3 (3)
Total	102 (100)

[a]The diagnosis for which the patient was admitted.
[b]8 HIV/AIDS patients were admitted with TB as the main diagnosis.

Table 2. *Distribution of hospitalised patients in different diagnostic groups.*

Footnote: Some diagnoses are under-represented because they have been classified under another main diagnose (e.g. diarrhoea classified under “malaria” and pneumocystic cariini pnueumonia classified in the HIV-group).

Diagnostic groups	Children n (%)	Men n (%)	Women n (%)	Maternity n (%)
Malaria	27(73)	3(10)	7(26)	0(0)
TB	2(5)	6(24)	6(23)	0(0)
HIV	3(8)	1(4)	2(8)	1(8)
Pneumonia	1(3)	1(2)	1(4)	0(0)
Other infections	0(0)	2(6)	2(6)	1(4)
Diarrhoea	1(3)	1(2)	0(0)	0(0)
Surgical diagnosis	3(8)	10(40)	6(23)	1(4)
Cardiovascular	0(0)	2(6)	1(2)	0(0)
Reproductive health conditions	0(0)	0(0)	1(4)	11(85)
Other diagnosis	0(0)	2(6)	2(6)	0(0)
Spot prevalence	37/102	25/102	27/102	13/102

Table 3. *Diagnostic groups in the different wards.*

	MANAGEMENT			
	Antimalaria	Antibiotics	Tuberculo-statics	Blood-transfusion
Malaria	58/68 (85%)	29/68 (43%)	0/68 (0%)	22/66 (33%)
HIV	5/29 (17%)	21/29 (72%)	9/29 (31%)	1/29 (3%)
Tuber-culosis	2/28 (7%)	19/28 (68%)	16/28 (57%)	1/28 (4%)

Table 4. *Management of malaria, HIV and TB*

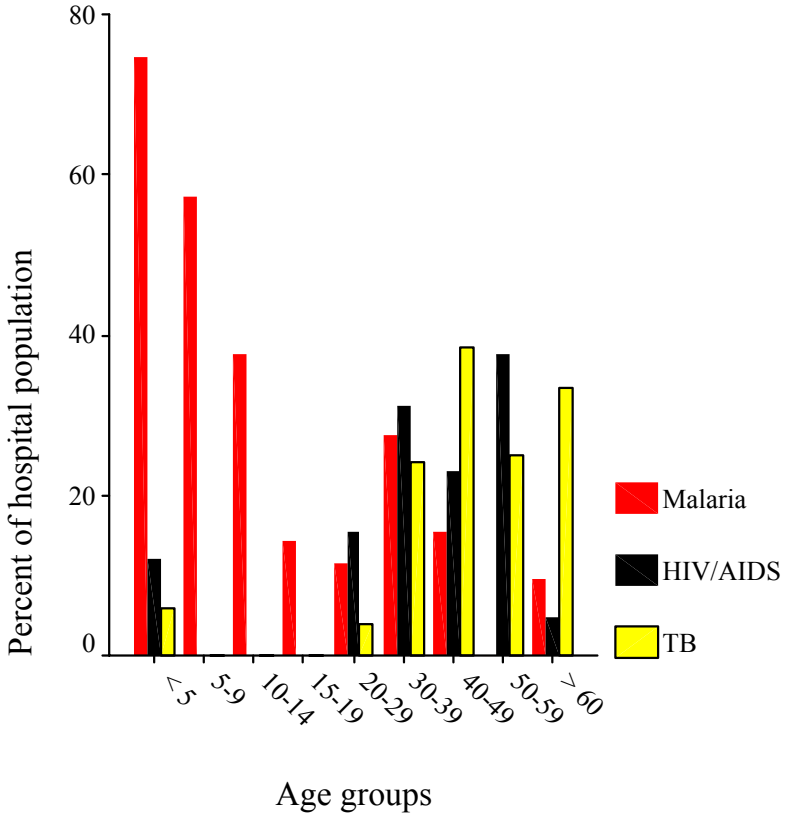

Figure 5: *Distribution of malaria, HIV and TB in the different age-groups*

Reference List

(1) Kafosec research project. Kagera information. http://www agr kuleuven 9c be/DIP/TRIO/Tanzania/info htm, **2006** [cited 2005 May 5];
Ref ID: 11

(2) Distribution of doctors among the population, by district, Kagera region, 1990 and 1998. http://www tanzania go tz/regions/kagera/hchild html **2006** [cited 2006 Sep 16];
Ref ID: 18

(3) TCCIA Kagera. Kagera looks ahead. http://www kagera org/aboutkagera/index htm **2006** [cited 6 A.D. Sep 5];
Ref ID: 17

(4) United Nations statistics division. Social indicators. http://unstats un org/unsd/demographic/products/socind/health htm **2006** [cited 6 A.D. Aug 28];
Ref ID: 10

(5) WHO, (World Health Organization). Tanzania: Main Public Health Issues and Concerns. http://www who int/hac/crises/tza/background/Tanzania_Feb05 pdf **2006** [cited 2006 Jun 10];
Ref ID: 26

(6) Egwaga SS. The impact of the HIV epidemic on tuberculosis transmission in Tanzania. AIDS **2006**;20(6):915-21.
Ref ID: 1

(7) WHO. The World Health Report:Rolling Out Child Health Interventions. http://www who int/whr/2005/chapter6/en/index4 html **2006** [cited 6 A.D. Sep 1];
Ref ID: 27

(8) Centers for Disease Control and Prevention. Malaria. **2006**.
Ref ID: 19

(9) Roll Back Malaria. The burden of malaria in Africa. http://www rbm who int/amd2003/amr2003/pdf/ch1 pdf **2006** [cited 6 A.D. Aug 22];
Ref ID: 23

(10) Landman K. Capacity of health-care facilities to deliver HIV treatment and care services, Northern Tanzania, 2004. International journal of STD & AIDS **2006**;17(7):459-62.
Ref ID: 14

(11) World Travel Guide. Tanzania-Climate. **2006**.
Ref ID: 20

(12) Kwesigabo G. HIV-1 infection prevalence and incidence trends in areas of contrasting levels of infection in the Kagera region, Tanzania, 1987-2000. Journal of acquired

immune deficiency syndromes **2005**;40(5):585-91.
Ref ID: 31

(13) AETC National Research Centre. **2006**.
Ref ID: 30

(14) Jane Crawley (Roll Back Malaria Department WGS. Reducing the burden of anemia in infants and young children in malaria-endmic countries of Africa. 71(Suppl 2), 2004 ed. The American Society Of Tropical Medicine and Hygiene, **2006**. p. 25-34.
Ref ID: 21

(15) Helge Brunborg. Norges samarbeidsland i Afrika
Hiv-/aids-epidemien svært utbredt. http://www ssb no/ssp/utg/200202/07/ **2006** [cited 6 A.D. May 10];
Ref ID: 8

(16) Joint United Nations Programme on HIV/AIDS (UNAIDS) WHO. AIDS epidemic update. **2004**.
Ref ID: 32

(17) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(18) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(19) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(20) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(21) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(22) Epidemiology HIV prevalence. http://www who int/sysmedia/pdf/countries/tza pdf **2006** [cited 6 A.D. Aug 4];
Ref ID: 12

(23) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet

pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(24) Epidemiology HIV prevalence. http://www who int/sysmedia/pdf/countries/tza pdf **2006** [cited 6 A.D. Aug 4];
Ref ID: 12

(25) Tanzania HIV/AIDS indicator survey. http://www statcompiler com/pdfs/TanzaniaHIVFactSheet pdf#search=%22%22hiv%20prevalence%22%20and%20age%22 **2006 September 11**
Ref ID: 5

(26) Larsen Øeta. Helse for de mange.Oslo: Gyldendal, **2003**.
Ref ID: 4

(27) Nasjonalt folkehelseinstitutt. smittevernhåndbok for kommunehelsetjenesten. **2005**.
Ref ID: 15

(28) Biharamulo Hospital. Farmacy: medication and equipment avilable at the hospital. **2006**.
Ref ID: 14

(29) Roll Back Malaria. The Africa Malaria Report-2003, chapter 3: Prompt and effective treatment. http://www rbm who int/amd2003/amr2003/ch3 htm **2006** [cited 6 A.D. Aug 20];
Ref ID: 24

(30) Jane Crawley (Roll Back Malaria Department WGS. Reducing the burden of anemia in infants and young children in malaria-endmic countries of Africa. 71(Suppl 2), 2004 ed. The American Society Of Tropical Medicine and Hygiene, **2006**. p. 25-34.
Ref ID: 21

(31) Roll Back Malaria. The Africa Malaria Report-2003, chapter 3: Promt and effective treatment. **2006**.
Ref ID: 11

(32) WHO. Child-adolecent-health. **2006**.
Ref ID: 16

(33) Eline L.Korenromp JRMA-S. Impact of malaria control on childhood anemia in Africa - a quantitative review. 9 ed. Blackwell Publishing Ltd, **2004**. p. 1050-65.
Ref ID: 22

(34) Murphy CSGaBJG. Gaps in the childhood malaria burden in Africa. Am J Trop Med Hyg **2001**;64:57-67.
Ref ID: 37

(35) Mtei L. High rates of clinical and subclinical tuberculosis among HIV-infected ambulatory subjects in Tanzania. Clin Infect Dis **2005**;40(10):1500-7.
Ref ID: 7

APPENDICES

Main diagnosis	n=	%
Abruptio placenta	1	0.6
Acute abdomen	3	1.8
Anemia unknown cause	3	1.8
Apoplexia	3	1.8
Benign prostata hyperplasia	4	2.4
Burns	1	0.6
CPD[a]	1	0.6
Diabetes	1	0.6
Diarrhoea unknown cause	4	2.4
Endometritis	1	0.6
False labour	4	2.4
Fetal distress labour	3	1.8
Fistula	1	0.6
Fracture	5	3.0
Gastroenteritis	1	0.6
Glomerulonephritis	1	0.6
Heart failure	6	3.6
Hernia	1	0.6
HIV	4	2.4
Hypertension	1	0.6
IUFD[b]/Neonatal death	1	0.6
Kaposis sarcoma	1	0.6
Labour	1	0.6
Malaria	34	20.5
Marasmus	3	1.8
Meningitis	4	2.4
Neonatal/postnatal sepsis	1	0.6
Obstructed labour	4	2.4
Ophthalmological diseases	2	1.2
Opportunistic infection	1	0.6
Osteomyelitis	5	3.0
Other infections	4	2.4
PID[c]	2	1.2
Placenta praevia	2	1.2
Pneumonia	12	7.2
Preeclampsia	1	0.6
Pregnancy complication	2	1.2
Psychiatric disease	2	1.2
Respiratory obstruction	1	0.6
Rheumatological diseases	3	1.8
Ruptured uterus	1	0.6
Scrotal swelling	2	1.2
Septic artritis	1	0.6
STI[d]	1	0.6
TB	15	9.0
Trauma	9	5.4
Urogenital disorder	1	0.6
UTI[e]	1	0.6
Total	166	100.0

[a] Cephalo-pelvic dysporportion.

[b] Intrauterine Fetal Death

[c] Pelvic Inflamatory Disease

[d] Sexually Transmitted Infection

[e] Urinary Tract Infection

Appendix 1: Frequencies of main diagnosis (the diagnosis the management is based on)

Second diagnosis	n=	%
Abruptio placenta	1	0,6
Anemia unknown cause	5	3
Benign prostata hyperplasia	1	0,6
Cellulitis	2	1,2
Cerebral Paresis	1	0,6
Cholera	1	0,6
Dehydration	1	0,6
Diabetes	1	0,6
Diarrhoea unknown cause	4	2,4
Fetal distress labour	3	1,8
Fracture	1	0,6
Gastroenteritis	1	0,6
Heart failure	3	1,8
HIV	18	10,8
Hypertension	1	0,6
Hypotension	1	0,6
IUFD/Neonatal death	1	0,6
Leg ulcer	1	0,6
Malaria	13	7,8
Malignancy	3	1,8
Marasmus	1	0,6
Musculo-sceletal disorders	1	0,6
Nefrotic syndrome	2	1,2
Neonatal/postnatalsepsis	1	0,6
Oportunistic infection	3	1,8
Osteomyelitis	1	0,6
Other infections	2	1,2
PID	1	0,6
Pneumonia	7	4,2
Pneumothorax	1	0,6
Pregnancy complication	4	2,4
Psychiatric disease	1	0,6
Schistosomiasis	1	0,6
Sequele after meningitis	1	0,6
STI	1	0,6
TB	11	6,6
Trauma	1	0,6
UTI	5	3
Missing	58	35
Total registered	108	65,1
Total	166	100

a Cephalo-pelvic dysporportion.

b Intrauterine Fetal Death

c Pelvic Inflamatory Disease

d Sexually Transmitted Infection

e Urinary Tract Infection

Appendix 2: Frequencies of second diagnosis.

Equipment available:

- Light microscopes (3) (Zeiss and Olympus, bulb or sunlight is amplified by a mirror)
- Colorimeter (corning) (Used for measuring haemoglobin)
- Haematocrit sentrifuge machine
- Photometer (Biosystem Bts-305, used for biochemical tests)
- Sentrifuge *CN 090*
- Incubator (for culture)
- Dip stick (Medi-Test. Test for urine analyses performed manually.)
- Water bath
- Scale (manual)
- Ultrasound (Philips Sono diagnost 100LC)
- X-ray (Philips Multi-Radiography System)

Appendix 3: Available diagnostic equipment at Biharamulo Designated District Hospital

The National guidelines for prescribing antimalarial drugs (2005): (1)		
Uncomplicated malaria	P.falciparum (uconfirmed)	Artemether-lumefantrine (ATM-LUM)
	P.falciparum (confirmed)	Artemether-lumefantrine (ATM-LUM)
Treatment failure	P.falciparum	Quinine (Q) (for seven days)
Severe malaria	P.falciparum	Quinine (Q) (for seven days)
Pregnancy	P.falciparum	Sulfadoxine/Pyrimethamine (SP)

Appendix 4: National policy and strategy for management of malaria in Tanzania. The table shows first line of treatment for malaria caused by P.falciparum. (Roll Back Malaria Monitoring and Evaluation)

Drug	Tanzanian shilling	American dollar
Quinine tablet	35 TZS	0,03 USD
Sulfadoxine/Pyrimethamin (SP) tablet	30 TZS	0,02 USD
Artesunat tablet	1100 TZS	0,89 USD

Appendix 5: The price of medication available at Biharamulo Designated District Hospital.